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EXAMINER
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CHEN, WENPENG

ART UNIT	PAPER NUMBER
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2624

DATE MAILED: 04/21/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/884,079

Applicant(s)

CHOI ET AL.

Examiner

Wenpeng Chen

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 21 October 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) 4 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3 and 5-14 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

**Examiner's responses to Applicant's remark**

1. Applicants' amendments and arguments filed on 10/21/2004 have been fully considered.
2. Page 12 of the amendments indicates two publications are attached. However, the cited publications are not attached. Please provide a copy for each in the next response.
3. Examiner's response for amendment to specification is given in "Specification" section below.
4. Applicants' arguments, filed on 10/21/2004 with regard to section 3(a) of paper #9 mailed 4/21/2004, related to rejection of Claims 1-14 under 35 U.S.C. 112, first paragraph are not persuasive.

Although Applicants cited the passages in page 8, line 17 through page 10, line 12, page 11, lines 5-13, and page 12, lines 6-22 of the present specification to rebut the question asked in the section 3(a), there is missed link between the end of relaxation labeling step and the step of comparing similarity between query images and model images. At the end of relaxation labeling after k iterations as shown in equation 3, how a label is assigned to a node of a query image is not transparent. The relaxation labeling only assigns probability of a label to a node. With the given probability, how the sum of the node-to-label distances is calculated? Please clarify this subject matter.

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5. Applicants' arguments, filed on 10/21/2004 with regard to sections 3(b) and 3(c) of paper #9, related to rejection to Claims 1-14 under 35 U.S.C. 112, first paragraph are moot due to the amendments.

6. Applicants' arguments filed on 10/21/2004 with regard to all art rejections are not persuasive. The Examiner has thoroughly reviewed Applicants' arguments but firmly believes that the cited references to reasonably and properly meet the claimed limitations.

a. Applicants' argument -- The Applicants alleged that Christmas paper does not teach the feature "wherein the binary relation is invariant with respect to rotations, scale changes and translations" recited in the amended Claim 1 and in the original Claim 4.

Examiner's response -- The Examiner disagreed. Claim 1 recites a method, among others, comprising:

-- defining *a binary relation* between lines of the query image and lines of the model images; and

-- wherein the binary relation is invariant with respect to rotations, scale changes and translations.

Clearly, *Claim 1 only requires one of the binary relations to be invariant with respect to rotations, scale changes and translations, not for each one of the used binary relations.*

Therefore, Christmas as cited by the Examiner meets the recited limitations because binary relations of angles are invariant with respect to rotations, scale changes and translations as pointed out by Christmas.

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*b.* Applicants' argument -- With regard to Claim 3, the teachings of Spiegel are not relevant or related to retrieval of model images from a database indexed by shape descriptors.

Examiner's response -- Christmas needs information of border, that comprises lines, as the shape descriptors for matching images. Spiegel's teaching providing a method of detecting border of an object is thus relevant. The motivation for their combination was provided in paper #9.

### *Specification*

7. The incorporation of essential material in the specification by reference to a foreign application or patent, or to a publication is improper. Applicant is required to amend the disclosure to include the material incorporated by reference. The amendment must be accompanied by an affidavit or declaration executed by the applicant, or a practitioner representing the applicant, stating that the amendatory material consists of the same material incorporated by reference in the referencing application. See *In re Hawkins*, 486 F.2d 569, 179 USPQ 157 (CCPA 1973); *In re Hawkins*, 486 F.2d 579, 179 USPQ 163 (CCPA 1973); and *In re Hawkins*, 486 F.2d 577, 179 USPQ 167 (CCPA 1973).

The incorporation of Korean Patent Application No. 2000-82756 in page 1 of the specification is proper because it is the foreign priority document of the present application. Please note that Applicants amendment to specification filed on 10/21/2004 delete this incorporation.

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However, as pointed out in the previous Office Action, the Applicants make incorporation of essential material in the specification by reference Korean Patent Application No. 00-62163 in page 7, lines 15-18. To overcome this objection, the Applicants can replace Korean Patent Application No. 00-62163 with U.S. Patent Application Publication No. 20020063718 (corresponding to U.S. Application No. 09/885.171) that claims priority of Korean Patent Application No. 00-62163, if U.S. Application No. 09/885.171 discloses exactly the same content as Korean Patent Application No. 00-62163. Otherwise this replacement will create "new matter" problem.

8. The amendment filed 10/21/2004 is objected to under 35 U.S.C. 132(a) because it introduces new matter into the disclosure. 35 U.S.C. 132(a) states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: the change in page 3 of the amendment with regarding to Eq. (2). The Applicants cited page 12, lines 17-22 for supporting the original disclosure of the amended subject matter. The Examiner likes to point out that the passage in page 12, lines 17-22 is for calculating *similarity*, while Eq. (2) is for calculating *compatibility*. They are different values defined in this specification. Passage in page 12, lines 17-22 does not support the amended material.

Furthermore, to relate the symbol  $\alpha$  in Eq. (2) to values that weights the labeling of neighboring nodes is new matter. It is also not convincing, because it is a constant without any relation to  $i$  and  $j$ . How can it be related to neighboring nodes?

Applicant is required to cancel the new matter in the reply to this Office Action.

***Claim Objections***

9. Claim 5 is objected to because of the following informalities: it depends from the cancelled Claim 4. Appropriate correction is required.

***Claim Interpretation***

10. For examining Claim 5 with the prior art, The Examination made the following interpretation:

-- In Claim 5, change [claim 4] to - claim 1 -.

***Claim Rejections - 35 USC § 112***

11. Claims 1-3, the interpreted Claim 5, and Claims 6-14 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

- a. Please see the Examiner's response and question in sections 4 above.
- b. The Applicants argued that "Zecker's theory" is well known. The Examiner agrees that "Zecker's theory" in a general form as provided in page 12 of this amendment is well known.

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However, in the specific form used by the Applicants, without knowing how to assign values to the symbol  $\alpha$  and the symbol  $\alpha_i$ , a person skill in the art need to perform experimentation to decide their values.

12. Claims 9 and 11-12 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

As explained above in paragraph 8, Claims 9 and 11-12 contain new matter that was not disclosed in the original application.

***Claim Rejections - 35 USC § 102***

13. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

14. Claims 1-2, the interpreted Claim 5, and Claims 6-7 and 10 are rejected under 35 U.S.C. 102(b) as being anticipated by Christmas et al. ("Structure Matching in Computer Vision



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Using Probabilistic Relaxation," Christmas, W. J. et al., IEEE Trans. On Pattern Analysis and Machine Intelligence, vol. 17, no. 8, August 1995, pages 749-764 cited previously.)

Christmas teaches a line based image matching method comprising:

-- collecting line information of a query image and model images; (right column , page 757, 1st-3rd paragraphs after section VII; The scene image is the query image. The model is the model image.)

- wherein the line information of each of the query and model images is expressed by shape descriptors; (right column , page 757, 1st-3rd paragraphs after section VII)

-- defining a binary relation between lines of the query image and lines of the model images; (Section II; right column , page 757, 1st-3rd paragraphs after section VII; Four binary relations are given.)

- wherein the binary relation is invariant with respect to rotations, scale changes and translations; (1st paragraph of page 758)

- wherein the binary relation includes at least one of an angular difference between two lines, a ratio of the lengths of the two lines, a relative location of the two lines, and a relative distance between the two lines; (3rd paragraph after section VII)

-- measuring compatibility coefficients of node-label pairs of the query and model images based on the binary relation; (section IV, page 753; Section VII in page 758, equations 44-45)

- wherein measuring the compatibility coefficients of the node-label pairs based on the binary relation comprises:

--- measuring the binary relation, denoted by  $\xi_{ij}$ , for two nodes  $i$  and  $j$  within the set of lines of the query image; (3rd paragraph after section VII; equation (18) in page 753)

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--- measuring the binary relation, denoted by  $\xi_{\lambda\lambda'}$ , for two labels  $\lambda$  and  $\lambda'$  within the set of lines for each of the model images; (3rd paragraph after section VII; equation (18) in page 753)

--- measuring the compatibility coefficients, denoted by  $r_{ij}(\lambda, \lambda')$ , for the node-label pairs of the query and each of the model images; (equation (18) in page 753; The  $p$  values are the compatibility coefficients.)

- wherein the compatibility coefficients  $r_{ij}(\lambda, \lambda')$  as a measure of the strength of compatibility between the node-label pairs have high values corresponding to compatibility and low values corresponding to incompatibility; (The exponential equation results in a high value when the difference between the binary relations of the node-label pairs is small.)

-- measuring the similarity between the query and model images on the basis of continuous relaxation labeling using the compatibility coefficients; (page 751, 2nd paragraph including Equation (1); last paragraph of Section III in page 753; Section VIII A shows that road images are matched to model images. Matching inherently requires measuring the similarity between the query and model images.)

-- wherein before measuring the similarity on the basis of the continuous relaxation labeling, further comprising assigning a uniform initial probability to a predetermined number of upper node-label pairs in which the sums of the highest degree of support by each adjacent label for the nodes are within the range of an upper level, the initial probability being close to the final probability. (section V; especially sub-sections V.B and B.C; Only a selected model labels are assigned a constant given in Eq. (36). When these values are inserted into the support equation (15), the sum is limited to a value of  $M_i \times$  the constant. Without specifying what is the condition close to the final probability, the selected initial condition is considered to meet the recited limitation.)

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15. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

16. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Christmas in view of Spiegel et al. (US patent 5,940,538 cited previously.)

Christmas teaches a line based image matching method comprising:

-- collecting line information of a query image and model images; (right column , page 757, 1st-3rd paragraphs after section VII; The scene image is the query image. The model is the model image.)

-- defining a binary relation between lines of the query image and lines of the model images; (Section II; right column , page 757, 1st-3rd paragraphs after section VII; Four binary relations are given.)

-- measuring compatibility coefficients of node-label pairs of the query and model images based on the binary relation; (section IV, page 753; Section VII in page 758, equations 44-45)

-- measuring the similarity between the query and model images on the basis of continuous relaxation labeling using the compatibility coefficients; (page 751, 2nd paragraph including Equation (1); last paragraph of Section III in page 753; Section VIII A shows that road images are matched to model images. Matching inherently requires measuring the similarity between the query and model images.)

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-- normalizing the set of lines to determine the normalized set of lines as the shape descriptors. (section VIII A; The image and map are scaled to match each other approximately. The lengths of lines are inherently normalized in the scaling process.)

However, it does not teach the extracting, thinning and concatenating steps recited in Claim 3.

Spiegel teaches a method of detecting border of an object comprising:

-- extracting the skeleton of an object image; (Fig. 12A; edge detector 1210; The edge is the skeleton.)

-- thinning the skeleton; (Fig. 12A; edge thinner 1230)

-- concatenating corresponding pixels based on the extracted skeleton to obtain a set of lines. (Fig. 12A; edge linker 1240)

It is desirable to increase the accuracy of line extraction. It is obvious that the accuracy of line extraction can be achieved with the increase of edge detection that as pointed out by Spiegel can be in turn achieved with edge thinning. (column 20, lines 7-16) It would have been obvious to one of ordinary skill in the art, at the time of the invention, to apply Spiegel's teaching to extract lines from Christmas's model and query because the combination improves the accuracy of line extraction and thus improves matching accuracy. The combination thus teaches:

-- extracting the skeleton of a model image;

-- thinning the skeleton;

-- concatenating corresponding pixels based on the extracted skeleton to obtain a set of lines.

17. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Christmas as applied to Claim 6, and further in view of Yu et al. (US patent 5,274,744 cited previously.)

Christmas as discussed above teaches Claim 6. Christmas further teaches updating probability according to Eq. (14) in page 752.

However, it does not teach to set the compatibility coefficients as recited in Claim 6. Yu teaches a relaxation labeling process:

-- wherein the compatibility coefficients  $r_{ij}(\lambda, \lambda')$  are determined as 1 if the relation of a node pair (i, j) coincides with the relation of a label pair ( $\lambda, \lambda'$ ). (column 1, line 52 to column 2, line 32)

It is desirable not to change the probability if these two relations are not related to improve the updating process. It would have been obvious to one of ordinary skill in the art, at the time of the invention, to apply Yu's teaching to modify, including normalization, Christmas's Eq. (14) to be in the range of  $[-1, 1]$ , therefore the compatibility coefficients  $r_{ij}(\lambda, \lambda')$  are determined as 1 if the binary relation of a node pair (i, j) of the query image coincides with the binary relation of a label pair ( $\lambda, \lambda'$ ) because the combination improves the updating process.

18. Claims 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Christmas as applied to Claim 1, and further in view of Imagawa (US patent 5,479,570 cited previously.)

Christmas as discussed above teaches Claim 1. However, it does not teach the feature related to measuring similarity recited in the claims.

Imagawa teaches a method of pattern matching for image (column 6, lines 55-58) comprising the following features:

-- where measuring the similarity between the query and model data features comprises:

- calculating the sum of the distances between corresponding query to model data feature pairs of the query and the model data; (column 8, lines 1-67; Because each pattern is represented by a vector given in Eq. (7), the distance given in Eq. (10) is the sum of the distances between corresponding query to model data feature pairs.)

- determining the reciprocal of the sum of the distances as the similarity between corresponding two query and model data features; (column 7, lines 53-67)

- wherein the distances are measured using the Euclidean distance. (Eq. (10))

It is desirable to have various approaches of pattern matching to provide process flexibility. It would have been obvious to one of ordinary skill in the art, at the time of the invention, to include Imagawa's steps for measuring similarity between the query and model images in Christmas's method because the combination improves flexibility. The combination thus teaches the following features:

- where measuring the similarity between the query and model images comprises:

- calculating the sum of the distances between corresponding node-to-label pairs of the sets of lines for the query and each of the model images; and determining the reciprocal of the sum of the distances as the similarity between corresponding two images.

### **Conclusion**

19. THIS ACTION IS MADE FINAL. See MPEP § 706.07(a). The Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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A shortened statutory period for response to this final action is set to expire THREE MONTHS from the date of this action. In the event a first response is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event will the statutory period for response expire later than SIX MONTHS from the date of this final action.

20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wenpeng Chen whose telephone number is 571-272-7431. The examiner can normally be reached on 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David K Moore can be reached on 571-272-7437. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9306 for regular communications and 703-872-9306 for After Final communications. TC 2600's customer service number is 571-272-2600.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 571-272-2600.

Wenpeng Chen  
Examiner  
Art Unit 2624

April 7, 2005

